The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

Application for Permission to Remove or cause to be removed Natural Gas from the Province of Alberta, under the Provisions of the Gas Resources Preservation Act by ~~Prairie Pipe Lines Limited~~ McColl-Frontenac Oil Co. and Union Oil of California.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

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W I T N E S S E S

E X H I B I T S

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MR. MACLEOD: Mr. Chairman, you expressed the wish yesterday to have Mr. Corette called for further examination.

THE CHAIRMAN: Yes.

MR. MACLEOD: I will call him now.

JOHN E. CORETTE, (recalled) already sworn:

THE CHAIRMAN: Do any of the counsel wish to cross-examine Mr. Corette?

Q MR. MACLEOD: Perhaps, sir, before there is any cross-examination, Mr. Corette has figures available to further break down those costs between pipe line and other costs given yesterday. It is at page - -

A It is at the very end of the statement, Mr. Macleod, at page 13.

Q Yes, pages 12 and 13.

Q MR. C.E. SMITH: Are these different from the figures in the application or the same?

A They are the same. The breakdown figures appear on page 19 of the original application.

Q That is what I had in mind.

A And these are the figures we would submit for the record as the breakdown of these costs. And in that connection I would say that these are actual costs and do not

include any charge for general office overhead or contingencies or interest during construction, and we have felt that these costs are subject to change as price levels change, and there has already been some change, we think, of about 10% in pipe costs since the time that this tabulation was prepared in August. There is one other matter about the gathering field, and that is, we believe the design might be changed at any time up to the day of construction depending on future drilling and on future discoveries.

THE CHAIRMAN: I think, Mr. Macleod, it might be just as well to give the Application an exhibit number. That will be Exhibit No. 7.

APPLICATION OF McCOLL-FRONTENAC OIL COMPANY LIMITED AND UNION OIL COMPANY OF CALIFORNIA MARKED EXHIBIT No. 7.

A Would you care to have read the costs appearing on page 19 or can they be included in the record from the exhibit?

THE CHAIRMAN: I think we can consider those as read unless there are any changes you want made.

A There are none other than the changes I have already made, Mr. Chairman. I might say that the costs of the measuring and regulation stations, the field drips, the dehydrators, communication and transportation equipment, the main line measurement, are all based on our experiences in the Cutbank field and the information we have with regard to the pipe installation costs and that kind of equipment in our own field. One item in here we feel we do not know enough about at this time to have reliable estimates is

the building and structures. We have not definitely made up our minds as to whether we would have to own our own houses for our own employees in the field and as to exactly what structures we would have to have, but the small item here of $20,000.00 for buildings and structures included only one house for living purposes and the other buildings were operating buildings.

Q THE CHAIRMAN: Does that include rights-of-way, land?

A There are no right-of-way figures included here specifically. From the study we had made of the law we understood that right-of-way on Government land would come through a permit from an official board here and other rights would have to be acquired, but I think we have no right-of-way costs in here.

Q Any further statement you wish to add?

A I believe not, Mr. Chairman.

CROSS-EXAMINATION BY MR. MARTLAND:

Q I have one or two questions, sir. Mr. Corette, it would appear from the figures on page 11 of your submission, Exhibit 2, that in 1949 more than half of the gas distributed by your company was for industrial consumers?

A That is correct.

Q That is correct. And apparently since that time there has been this additional commitment incurred to the Anaconda Company of Great Falls?

A Yes.

Q So that it is really correct, as my friend, Mr. Bruce

Smith, put it yesterday, that the main reason you require additional supplies from Canada is to meet your industrial commitments?

A I do not believe that that logically follows for this reason, that if you take the tables which have been presented here and eliminate the so-called large industrial load and take the annual consumption of the other load you will find that our present reserves in the United States would give us a supply for only a little in excess of 20 years. In view of that situation, we feel that, with or without the industrial business, we should have additional supplies. But unless there was a very serious situation we naturally would not want to curtail deliveries to industrial customers or eliminate industrial customers because those customers have been connected, with the exception of the very few new ones, ever since we went into the gas business in 1930 and 1931, and they helped carry us through our lean days, and of course we want to take care of them as well as we possibly can.

One other thing, those industries are industries that are located there because of the existence of the minerals and metals and natural resources which are produced there, and I do not see any possibility of any industry of that kind changing location by reason of fuel supply or anything else other than the exhaustion of the minerals that are used in those industries.

Q Then was the new commitment, the Anaconda Company, made before or after the contract was entered into with McColl-

Frontenac and Union Oil?

A It was made before the formal contract was signed but it was made at about the same time that the verbal agreement was made between Union Oil and Montana Power and McColl-Frontenac.

Q Are you going to produce the contract between your company and the McColl-Frontenac and Union, Mr. Corette?

A I had not expected to.

Q The contract has been filed on some of these applications. I suppose there is a copy here, is there?

MR. MACLEOD: I have a copy, sir, and would be glad to make it available to the Board. I do not think it is a matter of common knowledge. I would suppose there were contracts between the applicants who owned any gas, not suppliers of gas. Our applicants are the owners of gas and I do not think it is material to this enquiry the details of the contract under which it is being sold to Montana Power. I do not think it is a matter that should be made public.

THE WITNESS: Mr. McKinnon, would it be in order for me to state what the Montana Power's position is in connection with the contract?

THE CHAIRMAN: Yes.

THE WITNESS: I feel this way about it, from our standpoint I can not see where the production of the contract or the public disclosure of its terms would make any difference, but I have felt from the standpoint of McColl-Frontenac that they are from time to time negotiating for the sale of gas that they might

develop in this area and it is entirely conceivable supposing that any application for export here might be granted, might not be granted, there is at least the possibility McColl-Frontenac Company might find itself in a position to re-sell these reserves, therefore I do not think I should be free to disclose the price because I thought I might be disclosing something that would be a disadvantage to McColl-Frontenac. There are no other terms in the contract there should be any hesitancy in giving evidence on. If the Board did want the price it might be given confidentially and notdisclosed to the public in general.

MR. C.E. SMITH: I do not think anything should be given to the Board confidentially, sir. That is one reason we are having public Hearings and I do think in view of the fact that upon the application of McColl-Frontenac - Union it appears that they are making the application and really it is Montana Power by reason of the set-up by way of various companies, and as they state, when they get licences and assign those licences, I suppose they are talking about permits, which this Board may be interested in to decide anything of that nature, but other people have submitted - - I do not know whether you call it contracts or not - - but some other people have submitted some evidence in any event along the same lines. I can not quite follow the idea that Mr. Corette has, or Mr. Macleod has, about disclosure. Is a matter of price not being disclosed or what? I think I am correct in saying their application

suggests an assignment if this permit were granted the applicant, it is immediately assigned to some other company controlled by Mr. Corette's company. That is the only reason you have in mind, Mr. Corette, the price?

MR. MACLEOD: Strictly speaking, I do not think the Board or the public are concerned with the details of this contract. It is already in evidence that we have agreed to dispose of the gas to Montana Power and I do not think the details of that transaction are matters of public interest. However, we are in the hands of the Board. We have a contract if they want it put in it is here.

MR. C.E. SMITH: There is no use giving you a permit if you are going to assign it to somebody.

MR. MACLEOD: We have disclosed we are going to assign it.

MR. C.E. SMITH: Providing there are not conditions which prevent you assigning it. I do not know that I should suggest to the Board to compel anybody to produce a document. I was wondering whether or not you thought it might be a proper thing to do, Mr. Macleod.

MR. MACLOED: If the Board wishes - -

THE CHAIRMAN: I think the contract should be produced, Mr. Macleod, under Section 4 of the Act, that we should know that you have entered into a contract to remove the gas from the Province.

MR. MACLEOD: I just have the one copy here. I am not going to distribute it, if that meets

with the Board's approval.

THE CHAIRMAN: We will mark it Exhibit 8.

CONTRACT BETWEEN McCOLL-FRONTENAC OIL COMPANY LIMITED AND UNION OIL COMPANY OF CALIFORNIA AND MONTANA POWER COMPANY MARKED EXHIBIT 8.

MR. MARTLAND: Could I finish, sir?

CROSS-EXAMINATION BY MR. S.B. SMITH:

Q Mr. Corette, as I understand your evidence and your answers to Mr. Martland this morning, they are to the effect that you consider that the Montana Power Company has a deficiency in reserves insofar as supplying its consumers apart from industrial consumers?

A I feel we are right on the bare edge wherein we should have more to give us an assured supply for our customers other than industrial.

Q And that is not a situation that has arisen within the past few days or months, is it? You have known of that situation for many months, and I suppose, for years?

A We have known of it for the last few years and have been making a very diligent effort to acquire additional reserves.

Q So that when you take into account the industrial load which you had and the additional industrial load you have lately assumed, your shortages of reserves are made more serious, aren't they?

A That is correct.

Q But you knew of those shortages when you entered into

the recent contract with the Anaconda company to supply it with gas, at Great Falls, is it?

A That is the location of the point of delivery.

Q You knew there were shortages when you took on those additional commitments?

A We knew of our situation.

Q What amount of gas do you supply under that contract with the Anaconda Company per year?

A Approximately 2½ billion cubic feet.

Q Have you got that contract here?

A No. I do not have a copy of that contract with me.

Q I would like to ask, sir, for the production of that contract and I suggest it is a very material matter.

MR. MACLEOD: Surely that is going somewhat far afield?

THE CHAIRMAN: I agree with you, Mr. Macleod. I do not think we should ask for that.

MR. S.B. SMITH: With every respect, I suggest it is very material. Here we have an application for a supply from Alberta of gas to Montana which is to a large extent at least to take care of an industrial load and a substantial part of that industrial load has been assumed by the Montana Power Company lately when it knew of its reserve position, so that the requirements of the Montana Power Company in regard to its industrial use and particularly the industrial use of the Anaconda Company to purchase, is I suggest, a very material matter for this Board, sir, with every respect.

THE CHAIRMAN: I think Mr. Corette

explained that the contract had been entered into with the Anaconda Company just prior to the signing of this new contract. Is that right?

THE WITNESS: That is correct. I should say this, the contract with the Anaconda Company was substantially agreed to but not signed prior to the signing of the contract with the Union Oil Company, and I think back over the actual date of signature the contract with the Anaconda Company was not signed until after June of this year, which, according to my recollection, is the date of the contract with McColl and Union.

MR. S.B. SMITH: With every respect, I suggest that the contract between Union and McColl and Montana Power Company is relevant to the enquiry before this Board, and the contract for which I am now asking is equally relevant because the first contract takes the gas into the hands of the Montana Power Company and the second contract is equally relevant because gas, if any, going out of Alberta, will be used for the Anaconda Company. It simply traces the gas through from the source to its consumption, sir, and in essence I submit it is really part of the contractual arrangements about the disposal of the gas which it is proposed to take from Alberta.

THE CHAIRMAN: I think, Mr. Smith, that the applicant has given us the information which the Board requires, showing how the load was made up, they have disclosed the amount of their industrial load, and I think that is as far as the Board is concerned. It is

all the information we require. They are disclosing the contract for the sale of the gas, they have disclosed the amount of their industrial load, and I think that is sufficient.

(Go to page 105)

Q THE CHAIRMAN: Mr. Corette, in Table I, I wonder if you would mind turning to that - -

A Yes.

Q - - you show a fairly big consumption in Helena, Anaconda and Butte as being the consumption or actual deliveries during 1949, and I think elsewhere in your exhibit you show the actual industrial delivery at around 7 billion during 1949?

A Yes.

Q Could you reconcile those figures as between industrial, commercial and domestic there, for those various cities, just the three I have mentioned there, Mr. Corette?

A I think that we could dig out of the material that we have here what part of the total deliveries at Butte and Anaconda shown in Table I, and perhaps also at Helena, we have the industrial load. I can say this, that the Butte figures include the deliveries to the mining operations of the Anaconda Copper Mining Company at Butte. The Anaconda figures include the deliveries to the smelting and production operations of that company at Anaconda. And at Helena there is only a very small quantity of industrial load there that goes to Anaconda company. They have a small zinc plant there. However, it is very small compared to the Butte and Anaconda figures. If you would like to have those details in the record with regard to that, I think in 15 or 30 minutes we might be able to figure that out for you.

Q Where does the additional 2½ billion load come in here?

A You are talking about Butte and Anaconda?

MR. MACLEOD: It is Great Falls.

Q THE CHAIRMAN: I think you told us yesterday -

A That was at the city of Great Falls. That is not reflected in Table I at all. It was not connected in 1949.

Q So that out of this, roughly speaking, 13 billion, 7 billion of that is industrial divided between Anaconda, Helena and Butte?

A Yes, 7 billion is industrial.

MR. C. E. SMITH: 773 at page 11, isn't it?

MR. BRUCE SMITH: 7773.

MR. C. E. SMITH: Yes, 7 billion 773 million odd.

A I think that includes the total - just one moment until I refer to that figure. Yes, at page 11 in the total relative usage for 1949 that 7 billion 773 million 498 thousand is the total industrial load, not merely Butte or Anaconda, but the Anaconda Mining Company load at Butte and Anaconda is approximately 7 billion.

Q THE CHAIRMAN: So that this industrial figure then only includes Anaconda and its operation, is that right? There is no other industrial load included in that?

A There is some other industrial load included in there, but of the 7 billion 773 million approximately 7 billion was the Anaconda Company load at Butte and Anaconda, and the remainder was other industrial loads spread throughout the entire system.

Q And the figure then that is shown in Table VIII, this industrial load, is that Anaconda alone?

A No, it is not. That includes the other small industrial load too.

Q I notice at the bottom of the statement there you say

that the small industrials are included in commercial, and that the industrial load remains constant there to 1970?

A Well, we have a number of other customers that were included in the large industrial load, small industrials like a little shop around town were included in the commercial, but out of 1951 industrial estimated consumption shown in Table VIII the 10 billion 922 in there, there is also industrial load. I would want to recheck those with our notes and correct them if it is not right, but there is a cement plant, an American Mining, Smelting & Refining plant at East Helena - could I submit a list of what is included in there?

Q Yes.

A Other than Anaconda?

Q Yes.

A I think that would be the most accurate way instead of relying on my memory.

Q And you do not anticipate any increase in that figure at all? In other words, you do not intend to take on any additional industrial loads?

A We looked at it this way, that we do not know of any now that is not included in there, and we have no way of forecasting what might develop, so that for the purposes of this submission we felt we had no reliable information upon which to make a forecast of any increase in the industrial load.

Q Yes?

A Our experience has been that because of our location, the transportation situation, the market situation, the scarcity of population, that hard as we try we have great

difficulty in attracting industries of any particular size other than those that are directly related to mineral resources, and the mineral resources down there are pretty well controlled at this time by these concerns that are in business now, so that we would look for any increase in large industrial to those present concerns, and we have discussed it with them and they have no plans for any particular change in gas use, and, therefore, we have included nothing under that industrial classification, that is, no increase.

Q In Table III you jump from 194 industrial to 464, but you explain it by what you might term the commercial, so that you differentiate between commercial and industrial?

A That is right. Could I have the last question read?

Q You see, you show an increase from industrial customers from 194 in 1945 to 464 in 1970?

A That is right. Those are the small industrials that we have classified with commercial.

Q What is the difference between your commercial and industrial? Into what categories do they fall? How do you define your category, Mr. Corette?

A I am afraid it is quite arbitrary, because the loads are so different there isn't any problem. If we get a large industrial, a smelter or a refinery or something, that uses a great quantity of gas, and the small industrials that we include along with the commercials are small businesses that build up around the city, such as a small foundry.

Q Yes?

A I can see where in many instances the company might have

trouble with that, but we do not have any that are on the line, they are either big or small.

MR. C. E. SMITH: May I just ask one question, sir?

THE CHAIRMAN: Yes.

Q MR. C. E. SMITH: With respect to what you were speaking of on Table VIII, Mr. Corette, that 10 billion 922, I take it that includes your 2½ billion approximately to Great Falls, is that right?

A Yes, it does.

MR. S. B. SMITH: Could I ask one question, sir?

THE CHAIRMAN: Yes.

CROSS-EXAMINATION BY MR. S. B. SMITH:

Q What are the proportions of your sales of electric power and natural gas, Mr. Corette?

A How would you like it, Mr. Smith, in dollar revenue?

Q I suppose that would be a satisfactory way, or in volume.

A I could give it to you either in kilowatt hours or in dollar revenue.

Q Perhaps the dollar value, I am just interested in finding out what the proportions are, what the proportion of the business was electric power and the proportion that was gas?

A I can tell you very quickly, it is quite close to 80% electric and 20% natural gas, based on the last 12 months' earnings.

THE CHAIRMAN: Thanks very much, Mr. Corette.

A Thank you, Gentlemen. Mr. McKinnon, could I add one comment, please, about the Anaconda load at Great Falls, which I think did have some influence on taking-on load?

Q THE CHAIRMAN: Yes.

A The company that was supplying that business prior to the time that we took it over draws gas from the Cut Bank field where we estimate we have approximately 80% of the reserves. In addition, they draw gas from the Kevin-Sunburst field and from some smaller fields east of there, as I testified, but we know they have certain commitments in their withdrawals from those other fields. We also know that in the past few years that their withdrawals from the Cut Bank field have been considerably greater than their proportion of the holdings in the field, so that we had a very definite feeling which we could not pin down to the exact number of billion cubic feet of gas that if we took over that load we would be supplying it with gas which was ours and which had been used to supply it by the other people without us getting any revenue from it, so that from an operating standpoint there was a real advantage to us in taking over that load. And knowing as much as you people know about the gas business and gas reserves, you will see that we could not pin that down, but where we owned practically all the acreage and they have a few leases set out in the middle of our leases, you can see the situation we had.

MR. C. E. SMITH: Let us not get into a discussion about drainage.

MR. MACLEOD: I would like to call Mr. Rodebaugh, Mr. Chairman, on the matter of costs.

THE CHAIRMAN: All right.

.....

K. D. RODEBAUGH, having been first duly sworn, examined by Mr. Macleod, testified as follows:-

Q Where are you from?

A Canal, Winchester, Ohio.

Q What is your occupation?

A I am a Petroleum and Natural Gas Engineer.

Q Now, you have a written statement here?

A I have.

Q And in it, I think, you have set out your experience and qualifications?

A That is correct, sir.

Q Perhaps you had better read it?

A Yes, sir. I was educated at Ohio State University, receiving a degree of Bachelor of Engineering in 1920. I am a registered Professional Petroleum and Natural Gas Engineer in the State of Texas. Following my graduation, I was employed as an assistant engineer with the Ohio Fuel Gas Company and the Pennsylvania Gas Company. I was an Associate Valuation Engineer with the Oil and Gas Division of the Income Tax Unit of the Treasury Department, Division Engineer for the Pure Oil Company, and Natural Gas Engineer for the Columbia Engineering and Management Corporation. In 1930 I was employed by Ebasco Services, Inc., and have been employed by them continuously since that time.

Q Just a moment. Perhaps we should ask about Ebasco, what they are?

A Ebasco Services Incorporated - -

THE CHAIRMAN: We know who they are.

MR. C. E. SMITH: We have heard about them before.

MR. MACLEOD: Thanks.

Q Will you go on, Mr. Rodebaugh?

A I will continue. My work during that period with Ebasco has been engineering work in connection with the planning, design and construction of natural gas systems, economic studies and investigations of natural gas systems, and inventory and appraisal work. My present position with Ebasco is Natural Gas Consultant.

Since formation of the Texas Eastern Transmission Corporation in 1947, who were the purchasers of the Big Inch and Little Big Inch pipe lines, extending from Texas and Louisiana to New Jersey, I have been engaged by them almost continuously in the preparation of pipe line designs, construction costs, operating costs and economic studies. During this period, their capacity has been increased from an initial of 430,000 MCF per day to 740,000 MCF per day, and an application is now pending before the Federal Power Commission to increase it to a total capacity of 1,140,000 MCF.

My particular assignment here was to check the adequacy of the design of the proposed pipe line system and to check the estimated cost of the pipe lines as proposed at this time. In order to make this check, I have spent the past six days in examining the data upon which the figures in Exhibit 2 are based. I am also familiar with the terrain through which the proposed pipe line will pass; in part, from my own observation and, in part, from my discussion with others who are familiar with it.

Also, I have examined the topographical maps covering the route. It should be recognized that all details are tentative to some extent being based upon present data.

I have found that the system as now proposed is adequate to transport the quantities of gas as shown in the submissions, and that the pressures required for transmission of this gas are within the safe working pressures of the pipe. The Panhandle Eastern formula was used in checking the design, and I have personally made all of the calculations required to check the capacities and the working pressures of these lines. The maximum working pressure was based upon calculations as prescribed for Division 2 in the A.S.M.E. Pressure Piping Code. This is in accordance with modern practice in the natural gas industry.

In checking the estimated costs of the proposed pipe lines, I have used the latest information available relative to pipe prices and contract prices for the construction and have made my calculations thereon. The pipe line costs, shown in Exhibit 2, are direct construction costs without any allowance for overhead. Allowing for overheads, my results exceed the estimates shown in Exhibit 2 by 7%, which I consider to be in essential agreement.

MR. MACLEOD: May I have that marked, sir?

THE CHAIRMAN: Exhibit number 9.

SHORT BRIEF RE GATHERING AND TRANSMISSION FACILITIES, PRESENTED BY MR. RODEBAUGH, MARKED EXHIBIT 9.

THE CHAIRMAN: Are there any questions?

MR. MARTLAND: I have no questions, sir.

Q DR. GOVIER: Mr. Rodebaugh, I have one question.

A All right, sir.

Q It does not bear specifically on the construction costs question, but I notice that you have had experience with the Ebasco Services in designing and construction of natural gas systems?

A Yes.

Q And economics, I suppose, and so on?

A Yes.

Q Could you help the Board at all by indicating to us what, in your opinion, would be a reasonable distance to reach out to obtain a certain sized reserve to tie into a gas transmission system?

A Well, I do not believe that I could answer that direct for this reason, that there are so many factors involved, and I think each specific case will have to be studied and stand on its own, and I say that for this reason, that there are lines that are 1200 miles in length running from down in Texas clear to New York City, and there are other lines that may be, say, 200 miles in length, so that I think each specific case would have to be studied, as you would have to know all the different factors involved.

Q Well, perhaps if we narrow it down a little bit you might be able to help us. Suppose there were a reserve of, oh, 100 billion cubic feet of gas 10 miles distant from a gas transmission line, would you think it would be economic to reach out the 10 miles to tie in that reserve.

A Well, I think it would providing the market existed and providing the load factor was suitable.

Q Well, that was the sort of thing I had in mind. In this Province we have quite a number of small fields that have rather small reserves and one of the problems the Board is faced with is to decide whether it is realistic or not to assume some of those small fields might be tied into a gathering system. Now, it has been suggested to us certain rules-of-thumb might apply in attempting to sort out those that might be tied in.

A I know of no rule-of-thumb. I hate to think that it can be determined by rule-of-thumb.

Q You would think that the individual conditions might vary so much that each case might be different?

A Yes. I would want to know the delivery and I would want to make a complete economic study, I think, before that could be arrived at.

Q Mr. Rodebaugh, are you at all familiar with the reserve situation in this Province?

A No, sir, I am not. That was outside of my assignment.

Q Do you have any experience in abandonment pressures of fields producing from the Lower Cretaceous or shallow sands?

A There again I think the abandonment pressure should be, and each specific case should be considered in an economic study. In other words, I would like to see figures on the whole thing, so that I have no ideas on the abandonment pressures.

Q You would not strike a figure of 100 or 200 pounds per

square inch?

A No, not without knowing all the factors.

DIRECT EXAMINATION BY MR. MACLEOD:

Q Just one question. In your checking of the figures in Mr. Corette's submission, you checked only pipe line figures?

A That is correct, sir.

Q You did not check the structures and surveys and all that?

A No, sir. I beg your pardon, Mr. Macleod?

Q You did not check those other items including surveys and structures?

A Surveys, of course, are part of the pipe line costs and I do have a figure for those. The rest of your statement is correct.

JOHN F. DODGE, having been first duly sworn, examined by Mr. Macleod, testified as follows:

Q You have your revised figures? I think the Board has them?

DR. GOVIER: That is Exhibit 4.

A THE WITNESS: I believe this would be Exhibit 10. I am sorry, it has already been put in as an exhibit. At the request of the Montana Power Company I prepared a revision of certain tables that were a part of Exhibit J-11 in the Joint Hearing. Since the tables in that original submission, original exhibit, were based upon estimates of the requirements of the Montana

Power Company which subsequently have been found to be insufficient, or at least, the Company desires to obtain a larger amount of gas from the Canadian sources for the year 1960, these tables then in effect are a revision of the takings with reference particularly to deliverability and year-in peak day loads from the Pakowki Lake field and differ from those originally submitted only insofar as the takings from the Manyberries field are concerned. The reason for making the change in Manyberries alone is that we found we had taken a relatively small amount of the gas reserves from Manyberries and that the additional takings could be provided for merely by increasing the number of wells taken from Manyberries, so that in the interests of saving time, and since this question did not come up until the Saturday immediately preceding the Hearing, I did not attempt a complete revision of all the takings but simply satisfied myself that we could obtain the gas required by drilling more wells in Manyberries. The changes, therefore, throughout these tables will be found to pertain only to the Manyberries field.

It should perhaps be said that it might have been more logical to also slightly increase the takings from Smith Coulee, because when one compares the proportion of gas taken out at the end of 20 years we find that we have more or less included Smith Coulee and only withdrawn 20% of the Smith Coulee, while we have withdrawn two-thirds of the gas from the other fields. I feel it was merely a preliminary study and probably would not be followed in detail in operation,

and therefore what I was primarily interested in was to demonstrate to the Board that the load which Montana Power Company desires to have made could be handled from the reserves and from the acreage without exceeding reasonable engineering practice or without exceeding the 25% rule which we followed in the original submission. I think that is substantially all there is to say about it.

EXAMINATION BY DR. GOVIER:

Q Dr. Dodge, are those revisions confined to the 10-year period 1961 to 1970?

A In effect they are, yes. If you compare the annual market requirements as set forth on Table 3 of this revision with those in the original submission you will find, my recollection, no change at all. Clearly no substantial change is made until after.

Q MR. C.E. SMITH: Until after 1960?

A Until after 1960.

Q DR. GOVIER: Dr. Dodge, I have not done this arithmetic but perhaps you have. Could you tell me what proportion of the number of sections in Manyberries field would be drilled out if 27 wells were drilled?

A Yes, I can. I have checked that just this morning. Mr. Beach's submission shows on page 8 a total acreage in the M sand of 15,000 and in the K sand of 9800, or a total acreage of 24,800. If 27 wells were drilled, without going into which zone they were drilled in, and I would prefer drilling individual wells to individual sands, you would have slightly more than 1 well to each

1,000 acres. I think it figures out to 1 well in 900 acres, so that you would not have 1 well to each section. I have not gone into the detail of locating the wells. I merely satisfied myself that we would have less than 1 well per section.

Q You believe 27 wells could economically and actually be drilled in that field?

A Yes. I have given consideration to that because that was one of the first things I thought of. Instead of the last well which you drill and allow a cost of $40,000.00 for drilling of that well and connecting it to the system, I estimated that that well would recover - - here we run into a little difficulty if you limit it to 25 years, you only have 5 years to recover. I overlooked the fact that the permit only ran for 5 years more. You would recover approximately a billion feet of gas from that well. If your permit runs out you have got to think about selling the gas to somebody else.

Q Isn't it for a limited term of years?

A For 25 years. Merely because the permit ran out it might not be sold to Montana Power Company but certainly you are not going to go out of business as a gas company merely because your permit runs out, you may want to sell it to somebody else. I have one other set of figures you might be interested in. I developed this in checking to what extent we had drawn on the several reserves and it shows that while at the end of 1970 we will have withdrawn on the average nearly 70% of the gas from Pendant d'Oreille, Manyberries and Black Butte, we would have

drawn only 22% of the gas from Smith Coulee. That is what I meant, if I had more time I would have reduced the other tables and permitted a more reasonable distribution of the withdrawals.

Q You said at the end of 1970. Is that what you meant?

A Yes, sir.

Q The end of 1970?

A Yes, that is correct.

Q You will have 70% from Manyberries, Pendant d'Oreille and Black Butte?

A A little less than that from Black Butte, but based on this set-up, which is a hypothetical set-up, we would only have withdrawn 22% from Smith Coulee. I would therefore prefer to take more out of Smith Coulee and slightly less out of some of the others.

Q Of course, Smith Coulee is by far the smallest reserve in any case?

A That is correct. It only has total marketable gas as of 1950 of 18 billion, but we have only withdrawn, according to our original ideas, around 4 billion of marketable gas by 1970. I mention this merely because when one makes that comparison as a check it looks a little queer.

Q What about the 45 wells in Pendant d'Oreille? Do you believe that number of wells can economically be drilled there?

A I do. I reviewed Dr. Beach's estimate of the acreage that we have there and the A sand, which is the first one I happen to be glancing at, we have something in the

order of 58,000 acres, 58,250 acres proven productive, and I have reviewed his data and I believe his production lines are reasonable and conservative, so that that would give us about a section and a quarter for each well, and also on the basis of the initial production on a 25% life basis of the last well which we drilled, those wells will pay out, again assuming you are going to sell gas to the end of the economic life of the property.

Q What would you take as the end of the economic life of the property?

A Well, we have used 100 pounds abandonment, and of course, the economic life of the property then in years depends on the rate that you will withdraw.

Q You believe 100 pounds would be a reasonable abandonment pressure for all four of those pools?

A I do. I have recently had an opportunity to review gas operations in Montana as a result of my contact with this case in this last week and I found a considerable number of those fields down there are on the border of 100 pounds and are continuing to supply substantial quantities of gas. I think Sunburst only has 107 pounds now. We were thinking they were going to continue down to about 50 pounds gauge.

Q Hasn't that been done by the use of well head compressors?

A Yes, field boosters. I heard Mr. Rodebaugh's answer to your question and I believe it depends entirely on the economic conditions surrounding the field at the time we reach this question of abandonment. I do not believe in arbitrarily assigning a pressure or making a general

statement as to what you might do without consideration of the conditions that are obtaining at the time that the problem faces you.

Q Of course, when you have to make an estimate before the problem faces you, you take 100 pounds?

A I think 100 pounds is safe because the fields are only 1500 feet, 2,000 feet in depth, and that is a reasonable pressure. I think you will recall, perhaps, that we have had a little of this discussion before and when you come to something about 10,000 feet deep I think perhaps 400 pounds. I used 400 pounds, as I recall, in Pincher Creek and around 500 pounds indirectly because I used an experience factor which we have developed in California of about 90% of the gas in place in recovery. That results in using an abandonment pressure of approximately 10% of your original reservoir pressure.

Q Thanks, Dr. Dodge.

EXAMINATION BY MR. C.E. SMITH:

Q You told Dr. Govier, I think, that according to your revised figures with respect to Manyberries that would give you about 70% withdrawal?

A You will have withdrawn approximately 70% of the gas at the end of the 20th year. 1970 would have been the 20th year.

Q Did you figure out what the percentage would be according to your figures before amendment, as they appear in J-11 without amendments?

A No, but it would only take a minute to do it, I think.

John F. Dodge,
Exam. by Mr. C.E. Smith.

Q I wondered if you have it in your notes or your head?

A I haven't it in my notes but we have the amount that would be withdrawn about that time. We could compare it. According to the original table, we would have withdrawn, we would have marketed - - I have to look out for this 95% factor. Well, in the order of - -

Q Roughly will do.

A 40 billion. The relative figures are of the order of 37 billion as compared to 66 billion under revision. If you look at Table 9 in the old J-11 exhibit we had almost exactly 37 billion and now we have slightly over 66 billion, so it is in the relation of 6 to 11, about 40%.

Q That is close enough.

A About 40% as compared to 70%.

(Go to page 124)

RE-EXAMINATION BY MR. MACLEOD:

Q Just one other question, Mr. Dodge. If you continued your withdrawals for five years from 1970, what would be the position?

A On the average we would reach approximately 85% if we continued the withdrawals at the rate of possibly what would be the allowable. I think we would reach something like 85% in Manyberries.

Q What relation would that bear to the complete exhaustion of the field?

A Well, it would be theoretical, on the allowable basis, but at that time your delivery rate would be very low because your deliverability then, of course, is down to a rather low figure.

CROSS-EXAMINATION BY MR. MARTLAND:

Q Just one thing, Mr. Dodge. I notice a slight discrepancy between the annual market requirements shown on Table III of your exhibit, which is now Exhibit 4, and Table IV of the exhibit that Mr. Corette filed, Exhibit 2. I just wondered if you could explain the difference?

A Table II?

Q Table III in your exhibit which is filed and Table IV of Mr. Corette's exhibit. I am looking in Table IV at the column headed "Canadian Sources"?

A Yes.

Q The 1951 there shows 9.24 and in your exhibit the 1951 is 9.57?

A I believe the difference is in the pressure, possibly. One is 14.4 and the other is 14.9. I have not checked it.

Q I see. That is probably it.

MR. C. E. SMITH: It says that at the bottom of one and the top of the other.

A I have not checked it, but I know there is a difference, but I have not related the two figures, but I believe there is that difference.

MR. MARTLAND: Thank you, that is fine.

THE CHAIRMAN: I think we might recess for ten minutes.

(Hearing resumed after short adjournment.)

MR. MACLEOD: I have given to the Board Dr. Beach's statement and I will call Dr. Beach.

HUGH H. BEACH, Recalled, already sworn, examined by Mr. Macleod, testified:

Q Dr. Beach, there were certain discrepancies pointed out in the original application to the Board yesterday?

A Yes.

Q In the original application and the submission Exhibit 1?

A We have endeavoured to answer these questions.

THE CHAIRMAN: We will mark that as Exhibit number 10.

BRIEF, EXPLANATION OF DIVERGENCES BETWEEN DATA SUBMITTED IN ORIGINAL APPLICATION OF EXHIBIT I MARKED EXHIBIT 10.

Q MR. MACLEOD: Possibly you might read this, Dr. Beach?

A Pardon, sir?

Q Possibly you might read this?

A Very fine.

EXPLANATION OF DIVERGENCES BETWEEN DATA SUBMITTED IN ORIGINAL APPLICATION AND EXHIBIT I of MCCOLL-UNION PRESENTATION - December 4th, 1950.

Interstitial Water: The present values for interstitial water were derived from use of a more reliable interstitial water curve. A copy of this curve is appended hereto. And I have had three copies photostated.

Q MR. C. E. SMITH: Does this apply to the Pendant d'Oreille field?

A That is a general statement, Mr. Smith.

Q I beg your pardon?

A That is just a general statement that I just made regarding the interstitial water. The first curve we used - -

THE CHAIRMAN: We better mark those as Exhibit 11, Dr. Beach.

A Fine, sir.

INTERSTITIAL WATER CURVE
SUBMITTED BY DR. BEACH
MARKED EXHIBIT 11.

Q MR. MACLEOD: Will you carry on, Dr. Beach?

A The permeability value of 600 plus or minus millidarcies which was used in the original application, and this statement is in reference to the "A" Sand, Pendant d'Oreille - -

Q MR. C. E. SMITH: To what, 490, was it?

A Yes. It appears as 460 in this submission or in the other submission.

Q Exhibit number 1?

A Yes, but that was a typographical error, and the typographical error is not incorporated in the calculations. We checked that last night.

Q MR. MACLEOD: That is, the result is correct?

A Yes, the result is correct. The permeability value of 600 plus or minus millidarcies which as used in the original application has been revised to 490 millidarcies on the basis of the data shown on the attached sheet. The figure 460 is a typographical error in Exhibit 1 and should read 490. This typographical error is not incorporated in the calculations.

PENDANT D'OREILLE FIELD

"A" Sand: Porosity shown in original application of 26.2% has been reduced to 24.5% on the basis of the complete tabulated porosity data shown on the attached sheets.

I might state at this time that this is the summary of the data used by the engineers in their calculations. We have copies of those, of course, our original core analyses sheets. They are quite voluminous, but if the Board should like them we could get the copies of them for them. Some of them are in California, some of them are in Texas and some of them are here, but that is at the Board's discretion.

THE CHAIRMAN: Well, the information is all contained in these appendices you have got here?

A The data that was used in the calculations?

Q And those were obtained - -

A - - from the sheets. I have, as far as I know, the sole copies of those sheets with me, if you care to examine them.

Q Well, if we require that further information later we will let you know.

A I see. There are a number of samples that are given in the matter of "A" Sand with respect to the various wells,

but there are some 70 samples have been considered in arriving at the summary.

The complete data supporting the factors of porosity and permeability for the other sands in Pendant d'Oreille are also shown on the attached sheets.

MANYBERRIES FIELD

On the attached sheets, all the available data on porosity for the Manyberries field are shown. The average of these data would indicate a value of 24.4% for the Manyberries sand. The values shown in Exhibit 1 of 22% and 20% were arbitrarily chosen in the interest of a conservative estimate. An interstitial water factor of 25% corresponds satisfactorily to the average permeability shown. After discussion with our reservoir engineers, the assumed value of 14% shown in the original application for the upper sand was changed to 20% as being more representative of the regional porosities of similar formations. We have no record of any place where we have reliable data of porosity being as low as 14% and yielding gas.

The interstitial water values for both sands are considered to be the same.

Q MR. C. E. SMITH: Before you go on, am I right in this, and I have a note here with regard to the interstitial water in your Manyberries sand, that it was in your original submission as 43?

A That is correct. I believe it was 43.

Q Don't bother if you haven't got it. I was just wondering if I had made a mistake here?

A I believe it was 43.

SMITH COULEE FIELD

In the absence of core analysis data from the wells drilled in the Smith Coulee field, values were chosen based upon regional similarity to the sands in Pendant d'Oreille field, a short distance to the northeast. It should be noted that inadvertently the footnote to the table on page 9 of Exhibit 1 was copied from the original submission and is no longer pertinent and should be deleted. That was on page 9 of Exhibit 1. That was put in there by error.

BLACK BUTTE FIELD

The only difference between the information provided in the original application and that of the present submission is in the employment of super-compressibility factors - these have been all calculated, where we had super-compressibility factors that were in excess of 1 - of 0.921 for the Ribbon sand, 0.927 for the Ellis sand and 0.920 for the Rundle in place of the obviously erroneous values shown in the original application.

Hugh H. Beach,
Re-exam. by Mr. Macleod.

WELL NO.	"A" Sand FT. SAND REPRESENTED	NO. OF SAMPLES	POROSITY %	PRODUCT POROSITYxFT.	PERMEABILITY MD	PRODUCT PERM.x FT
6d-12-5-10	10	3	26.5	265.0	1197	11,970
6D-12-5-10	8	4	23.1	184.8	40	320
6D-25-4-10	19	8	22.6	429.4	170	3,230
6D-25-4-10	4	4	20.4	81.6	91	364
10D-9-4-9	15	9	27.8	417.0	1024	15,360
10D-9-4-9	11	5	21.1	232.1	78	858
7C-34-3-9	3	1	27.1	81.3	281	843
7C-6-4-8	15	6	28.7	430.5	723	10,845
7C-6-4-8	3	3	24.2	72.6	368	1,104
6D-12-4-8	17	5	25.3	430.1	571	9,707
6D-12-4-8	11	3	20.5	225.5	228	2,508
4B-16-3-8	8	5	24.7	197.6	604	4,832
11A-35-2-8	3	3	26.3	78.9	1018	3,054
11A-35-2-8	6	7	20.6	123.6	470	2,820
10B-19-2-7	4	2	25.2	100.8	190	760
10B-19-2-7	4	2	19.4	77.6	111	444
	141	70		$\frac{3,428.4}{141}$ = 24.3		$\frac{69,019}{141}$ = 489
				Used 24.5		Used 490
	"B" Sand					
6D-12-5-10	1	1	21.9	21.9	2010	2,010
4B-16-3-8	1	1	23.3	23.3	605	605
11A-35-2-8	2	4	22.2	44.4	481	962
	4	6		$\frac{89.6}{4}$ = 22.4		$\frac{3,577}{4}$ = 894

Hugh H. Beach,
Re-exam. by Mr. Macleod.

PENDANT D'OREILLE

"D" Sand

WELL NO.	FT. SAND REPRESENTED	NO. OF SAMPLES	POROSITY %	PRODUCT POROSITYxFT.	PERMEABILITY MD	PRODUCT PERM.xFT
11A-35-2-8	5	8	22.4	112.0	260	1,300
10B-10-2-7	4	3	22.5	90.0	30	120
4B-16-3-8	6	4	18.1	108.6	76	456
	15	15		$\frac{310.6}{15}$ = 20.7		$\frac{1,876}{15}$ = 125

"E" Sand

10B-19-2-7	3	1	23.6	70.8	65	195
4B-16-3-8	13	4	24.0	312	90	1,170
11A-35-2-8	2	4	25.6	51.2	58	106
	18	9		$\frac{4340}{18}$ = 24.1		$\frac{1,471}{18}$ = 82

MANYBERRIES

	No. of Samples	Porosity %	Permeability md
Well No. 11-A-29-45			
	3	25.6	80
Well No. 7-13-5-6			
	1	29.4	891
	1	29.6	895
	1	30.0	755
	1	22.2	37
	1	20.6	83
Well No. 7-C-6-55			
	1	24.4	66
	1	24.1	27
	1	23.3	85
	1	24.0	39
	1	21.1	9
	1	18.5	3
	1	23.7	14
Total	13	316.5	2984
	Arithmetic avg.	24.3	229.5

Corresponding interstitial water for 229 md - 23%
Used - 25

EXAMINATION BY MR. C. E. SMITH:

Q Do the same remarks apply to the compresibility factors at original pressures?

A Pardon, sir?

Q Do the same remarks apply to the heading above, the compressibility factor at original pressure?

A I am not sure that I understand.

Q Have you page 10 of Exhibit 1, Ribbon Sand, 0.84, do you see that?

A The supercompressibility factor at 100 pounds?

Q No, above that.

A The compressibility factor at original pressure?

Q Yes?

A I would have to look in the application. I cannot answer that.

Q I have got 0.84 where you have testified 1.115 throughout.

A At the reservoir pressures that we are dealing with here the super-compressibility factor in excess of 1 is not possible and we are not sure how that was used. We brought the reciprocal - the engineer who made that particular calculation is in Texas, the Texas Company's office in Houston, it has not been practical to check how he arrived at that usage, and in later consideration of the data we checked that up.

Q MR. MACLEOD: Where are the corresponding figures in the original application, Dr. Beach?

A In the original application?

Q Yes? It is at page 8.

A That statement applies to both, Mr. Smith. We believe this original data was erroneous.

Q MR. SMITH: It does apply to both?

A Yes, that is right.

Q That is all I wanted.

Q DR. GOVIER: Dr. Beach, I am not quite sure that I understand the way that you have arrived at your interstitial or connate water figure. First, let me ask you, is this chart, Exhibit number 11, a representation of tests made on cores from the Pendant d'Oreille field only?

A That curve there is based on factual data. I do not have another copy. The actual well numbers are listed here (indicating).

Q Yes?

A Now, I would have to check those to see whether that is. That is a Pendant d'Oreille well (indicating); that is a Pendant d'Oreille well (indicating); I believe that is; I am not sure about this one, it is pretty close to the bottom of the field, but whether it is in the north part of the Black Butte or the South part of Pendant d'Oreille, I am not just too sure. I could just check on the number. That is 7C-32-2-8?

Q No, 10D-12-4-8. You had better check those, Dr. Beach, and make sure when you are checking.

A The three of them are actually in the field and one of them, that is, 6D-12-4-8 is a well that was below water line on the East side of the field of Pendant d'Oreille.

Q This chart then represents the data taken from the three wells in the Pendant d'Oreille field, and one of them is to the East of the field?

A Yes.

Q Do the data embrace more than one of the sands in the Pendant d'Oreille field?

A I cannot answer you that. I might give you the history of the curve. Before we entered into computations regarding the possibility of gas export and each company giving it from their own calculations regarding reserves and otherwise, taking those into consideration, but we have attempted to give the most reliable estimate we could, and we have since obtained other data, that is, the Union Oil Company of California curve made in their core lab. in Los Angeles, and we had the Texas Company curve, but our engineers regard this one as the more reliable curve.

Q I see.

A And I cannot answer you what the distribution of the actual results relative to the sands are.

Q Perhaps you can tell me this, Dr. Beach, are you interpreting these data to represent the general average for all conditions anywhere encountered in the Pakowki Lake area?

A That curve is being used - -

Q - - used as a general curve?

A As a general one.

Q I see. So that where you have information on permeability - -

A We checked that with the curve.

Q You check with this curve to get the corresponding figure for connate water, is that correct?

A That is my understanding of it, sir.

Q I see.

A Just one further point with regard to that curve, and the scattered points there, it is possible to arrive at different curves that could be drawn, but the form is based, as I

understand, on a considerable research in the form of similar curves where there is more data, and it is put on there as accurately under that method of interpretation as possible.

Q Yes, I know what you mean there. Now, in the first paragraph of Exhibit 10 you say, "The permeability value of 600 plus or minus millidarcies, which was used in the original application has been revised to 490 millidarcies." Now, are you referring there to Pendant d'Oreille?

A Pendant d'Oreille, yes, sir.

Q And to all sands in Pendant d'Oreille?

A Well, that is to the "A" Sand, the total "A" Sand should have been given there.

Q That is the "A" sand of Pendant d'Oreille?

A That should have come before the sentence commencing "The permeability".

Q Oh, I see.

A This was typed just minutes before we came over here and we did not have an opportunity of checking.

Q And you explain the origin of that 490 figure on Exhibit 10, is that right, where you are using the 490?

A That is right, sir. The calculations come to 480, and that is weighted on the basis of footage distribution of the wells.

Q And you also explain the 24.5 porosity figure in that same Table?

A Yes, sir.

Q And then am I right in assuming this, that you then took the 490 millidarcy figure, and it refers to the chart, and you took out the connate water figure, is that correct?

A That is my understanding.

Q Well, my reading of the chart would indicate a figure of 17 or 18%. Now, what did you actually use?

A On the "A" sand?

Q MR. C. E. SMITH: 18%?

A 18.

(Go to 137)

Q DR. GOVIER: 18%?

A Yes.

Q And did you follow that same procedure for each of the other sands?

A That is correct, where we have the data.

Q Well, with regard to the "B" sand, you have a permeability of 894, which would seem to indicate a connate water of about 15?

A That is correct.

Q Is that right?

A That is right. That is what we have.

Q And the "C" sand, you do not have the "C" sand at all?

A We have an estimated permeability of 200, and we have estimated an interstitial water.....

Q Of 25?

A Of 25.

Q And the"D" sand is 125?

A And 32.

Q I see. And then have you done exactly the same thing in taking each of the other fields? You give figures for Manyberries, so that I assume you have done the same thing for Manyberries, but there are no figures here for Black Butte or Smith Coulee?

A Yes, that is correct.

Q But you have followed that same procedure?

A Yes, that is my understanding. I would have to be absolutely sure and check with our engineers, but I think that is correct.

Q And you are submitting Exhibit Number 11 to show permability and connate water data and a curve placed to

represent that data taken into account and not only that data but your knowledge of the shape of the curve based on other work, is that right?

A That is correct, sir.

Q Dr. Beach, on pages 3 and 4 where you give the porosity data you have a column headed "Number of Samples". I presume you mean Number of Core Samples, do you?

A Number of Samples that have been taken from the cores. Most of the formations we cored continually. Certainly in the early stages we cored continually, then we were able to do differential coring as we became more acquainted with it.

Q These are the number or core plugs cut from the cores?

A Yes, that is correct. In general, those samples were canned or wrapped in lead foil and we even attempted to wax them in order to get reliable data.

MR. MACLEOD: That is our case, Mr. Chairman. You asked Mr.Corette for a breakdown of his figures. Would it be all right to mail that in tomorrow?

THE CHAIRMAN: That will be all right, Mr. Macleod. Mr. Macleod, would you submit a written brief to the Board summarizing your case?

MR. MACLEOD: Covering the joint hearing?

THE CHAIRMAN: Yes.

MR.MACLEOD: When would you like it?

THE CHAIRMAN: As soon as you can get it ready for us. The Hearing will be closed.

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